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(54) MELAMINE RESIN FOAM COMPOSITIONS

(71) We, MELAMINA ULTRA S.A. INDUSTRIA QUIMICA, a Brazilian Body Corporate, of Rua dos Algibebes, 6-sala 304, Caixa Postal, 1616-Salvador, Brazil, and COORDENACAO DOS PROGRAMAS DE POSGRADUACAO DE ENGENHARIA DA UNIVERSIDADE FEDERAL DO RIO DE JANEIRO, —COPPE/UFRJ of Centro de Tecnologia, Bloco G Ilha do Fundao, Caixa Postal 1191, ZC-00 Rio de Janeiro Guanabara, Brazil, do hereby declare the invention, for which we pray that a patent may be granted to us ,and the method by which it is to be performed, to be particularly described in and by the following statement: —

This invention relates to rigid closed cell foams in particular rigid foams based on melamine-form-aldehyde resins, optionally containing various fillers and also to a process for manufacturing such compositions.

According to the present invention there is provided a rigid closed cell foam obtained by the polymerisation of a mixture comprising water, one or more melamine-formaldehyde prepolymers and an acid surface active agent, said foam having a compressive strength of 5.0 to 80 kg/cm², as hereinafter defined.

The mixture from which the rigid foam is obtained may additionally comprise a catalyst, for example an acid catalyst, for promoting the polymerisation reaction of the melamine-formaldehyde prepolymer.

In a further aspect of the present invention there is provided a process for preparing a rigid foam which process comprises expanding a mixture of water, an acid surface active agent and one or more melamine - formaldehyde prepolymers, and allowing the prepolymer to polymerise to form a rigid closed cell foam having a compressive strength of 5.0 to 80 kg/cm², as hereinafter defined.

Preferably the foam comprises one or more inert fillers which may be inorganic or organic fillers.

In this specification, the compressive strength of the foam is defined according to the result obtained by the testing method of the International Union of Testing and Research Laboratories for Materials and Structures (RILEM RECOMMENDATION CPC 4) (1) Materials and Stuctures vol. 6, No. 30, 1972.

In the process for preparing the rigid foam the water and the surface active agent may be initially mixed together and agitated to form a foam. Alternatively the water and surface active agent may be initially mixed together and a gas bubbled into the mixture to form a foam. Furthermore, the water and surface active agent may be initially mixed together and a gas generated in situ in the mixture to form a foam.

A solution of the melamine-formaldehyde prepolymer may then be added to the foam which polymerises to yield a rigid closed cell foam.

Preferably the water and surface active agent are initially mixed together with a volatile organic solvent, a solution of melamime - formaldehyde prepolymer is added to the mixture, the polymerisation reaction of the prepolymer being sufficiently exothermic to expand the reaction mixture.

The foams of the present invention are rigid materials of various densities, based on melamine-formaldehyde resins and optionally various inorganic fillers which have slow or difficult combustion. The fillers may be added to the foam of the melamine-formaldehyde prepolymer and after curing thereof, foams may be obtained, which can be used extensively in the building industry in the form of constructional materials such as partition wals, lowered ceilings and linings, bricks for indoor and outdoor walls, and decora-

tion may then be moulded into a desired shape.

If pure melamine formaldehyde foam is desired the addition of one or more fillers may be omitted.

Typical proportions or relative amounts of prepolymer, water, surface active agent, acid catalyst and filler, e.g., an inert mineral powder, as used in the present invention are given in the Table below;

Table

Components	*Parts by weight*
Melamine-formaldehyde prepolymer(s)	100
Acidic surface active agent	2 to 10
Water	100 to 800
Acid catalyst	0 to 2.5
Filler	0 to 200

In general the properties of a rigid foam composition prepared as described above may be listed as follows:

a) The colour of the material usually depends upon the filler added. In the case where the foam has no filler added thereto the colour is generally white. The product has been found to exhibit low density, the fragility of the material increasing with a decrease of its density, but even in formulations of low density the material may withstand manual compression and tension.

b) The product has been found to withstand the action of water and corrosive agents and it does not undergo modifications in its properties when in prolonged contact with such agents.

c) The apparent density of the material is generally in the range of 0.05 g./cm^3 up to densities of about 1.00 g./cm^3, depending upon the quantity of water and surface active agent of the formulation.

d) The product had a compressive strength of 5.0 kg/cm^2 to 80 kg/cm^2, increasing linearly with the density.

e) The material had an internal cellular structure, formed of closed cells, which gives it exceptional thermal and acoustical properties.

Its external surface, however, showed an attractive appearance with a bright coat of resin without discontinuities.

f) The material was not combustible.

g) The surface of the material may be painted by conventional methods and products or even coated with commercially available materials such as decorative wall-paper, metal foils and wooden sheets and even other types of finishing with laminated plastic material.

WHAT WE CLAIM IS:—

1. A rigid closed cell foam obtained by the polymerisation of a mixture comprising water, one or more melamine-formaldehyde prepolymers and an acid surface active agent, said foam having a compressive strength of 5.0 to 80 kg/cm^2 as hereinbefore defined.

2. A foam as claimed in claim 1 which additionally comprises an inert filler.

3. A foam as claimed in claim 2 wherein the inert filler is an inorganic filler.

4. A foam as claimed in claim 2 wherein the inert filler is an organic filler.

5. A foam as claimed in any one of the preceding claims and obtained by the polymerisation of the mixture additionally comprising a catalyst for promoting the polymerisation reaction of the melamine-formaldehyde prepolymer.

6. A foam as claimed in claim 5 wherein the catalyst is an acid catalyst.

7. A foam as claimed in claim 5, the mixture comprising for each 100 parts by weight of melamine-formaldehyde prepolymers, from 2 to 10 parts by weight of the surface active agent, from 100 to 800 parts by weight of water, from 2 to 5 parts by weight of an acid catalyst for promoting the polymerisation reaction and up to 200 parts by weight of an inert filler.

8. A process for preparing a rigid foam which process comprises expanding a mixture of water, an acid surface active agent and one or more melamine-formaldehyde prepolymers, and allowing the prepolymer to polymerise to form a rigid closed cell foam having a compressive strength of 5.0 to 80 kg/cm^2, as herinbefore defined.

9. A process as claimed in claim 8 wherein the water and the surface active agent are initially mixed together and agitated to form a foam.

10. A process as claimed in claim 8 wherein the water and surface active agent are initially mixed together and a gas is bubbled into the mixture to form a foam.

11. A process as claimed in claim 8 wherein the water and surface active agent are initially mixed together and a gas is generated in situ in the mixture to form a foam.

12. A process as claimed in any one of claims 9 to 11 wherein a solution of the melamine-formaldehyde prepolymer is added to the foam which polymerises to yield a rigid closed cell foam.

13. A process as claimed in claim 8 wherein the water and surface active agent are initially mixed together with a volatile organic solvent, a solution of melamine-formaldehyde prepolymer is added to the mixture, the polymerisation reaction of the prepolymer being sufficiently exothermic to expand the reaction mixture.

14. A process as claimed in any one of claims 8 to 13 wherein a catalyst for promoting the polymerisation reaction is

tion may then be moulded into a desired shape.

If pure melamine formaldehyde foam is desired the addition of one or more fillers may be omitted.

Typical proportions or relative amounts of prepolymer, water, surface active agent, acid catalyst and filler, e.g., an inert mineral powder, as used in the present invention are given in the Table below;

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b) The product has been found to withstand the action of water and corrosive agents and it does not undergo modifications in its properties when in prolonged contact with such agents.

c) The apparent density of the material is generally in the range of 0.05 g./cm^3 up to densities of about 1.00 g./cm^3, depending upon the quantity of water and surface active agent of the formulation.

d) The product had a compressive strength of 5.0 kg/cm^2 to 80 kg/cm^2, increasing linearly with the density.

e) The material had an internal cellular structure, formed of closed cells, which gives it exceptional thermal and acoustical properties.

Its external surface, however, showed an attractive appearance with a bright coat of resin without discontinuities.

f) The material was not combustible.

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WHAT WE CLAIM IS:—

1. A rigid closed cell foam obtained by the polymerisation of a mixture comprising water, one or more melamine-formaldehyde prepolymers and an acid surface active agent, said foam having a compressive strength of 5.0 to 80 kg/cm^2 as hereinbefore defined.

2. A foam as claimed in claim 1 which additionally comprises an inert filler.

3. A foam as claimed in claim 2 wherein the inert filler is an inorganic filler.

4. A foam as claimed in claim 2 wherein the inert filler is an organic filler.

5. A foam as claimed in any one of the preceding claims and obtained by the polymerisation of the mixture additionally comprising a catalyst for promoting the polymerisation reaction of the melamine-formaldehyde prepolymer.

6. A foam as claimed in claim 5 wherein the catalyst is an acid catalyst.

7. A foam as claimed in claim 5, the mixture comprising for each 100 parts by weight of melamine-formaldehyde prepolymers, from 2 to 10 parts by weight of the surface active agent, from 100 to 800 parts by weight of water, from 2 to 5 parts by weight of an acid catalyst for promoting the polymerisation reaction and up to 200 parts by weight of an inert filler.

8. A process for preparing a rigid foam which process comprises expanding a mixture of water, an acid surface active agent and one or more melamine-formaldehyde prepolymers, and allowing the prepolymer to polymerise to form a rigid closed cell foam having a compressive strength of 5.0 to 80 kg/cm^2, as herinbefore defined.

9. A process as claimed in claim 8 wherein the water and the surface active agent are initially mixed together and agitated to form a foam.

10. A process as claimed in claim 8 wherein the water and surface active agent are initially mixed together and a gas is bubbled into the mixture to form a foam.

11. A process as claimed in claim 8 wherein the water and surface active agent are initially mixed together and a gas is generated in situ in the mixture to form a foam.

12. A process as claimed in any one of claims 9 to 11 wherein a solution of the melamine-formaldehyde prepolymer is added to the foam which polymerises to yield a rigid closed cell foam.

13. A process as claimed in claim 8 wherein the water and surface active agent are initially mixed together with a volatile organic solvent, a solution of melamine-formaldehyde prepolymer is added to the mixture, the polymerisation reaction of the prepolymer being sufficiently exothermic to expand the reaction mixture.

14. A process as claimed in any one of claims 8 to 13 wherein a catalyst for promoting the polymerisation reaction is

added to the mixture of water, surface active agent and melamine-formaldehyde prepolymer.

15. A process as claimed in any one of claims 8 to 14 wherein one or more inert fillers is added to the mixture before polymerisation of the prepolymer is complete.

16. A process for preparing a rigid foam as claimed in claims 8 substantially as hereinbefore described in the specific example.

17. A rigid foam as claimed in claim 1 substantially as herein before described in the specific example.

18. A rigid foam whenever prepared by a process as claimed in any one of claims 8 to 16.

19. Shaped or moulded articles comprising a rigid foam as claimed in any one of claims 1 to 7 or 17 and 18.

20. Constructional materials whenever comprising a rigid foam as claimed in any one of claims 1 to 7 or 17 and 18.

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